Original Article

Factors Associated with Out-of-Pocket Payments for Refractive Surgery in Tehran, Iran

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Abstract

Purpose: Out-of-pocket (OOP) expenses are a major factor influencing patients' decisions to undergo refractive eye surgery. This study aimed to identify the factors associated with OOP payments for refractive surgery in selected medical centers in Tehran, Iran.

Patients and Methods: In this cross-sectional study, 200 adults undergoing refractive surgery (LASIK, LASEK, or PRK) were recruited through cluster sampling from state and private hospitals in Tehran surgery centers, Iran, in 2025. Data were collected using a contingent valuation questionnaire to estimate patients' maximum OOP payments. Factors influencing OOP costs were analyzed using ANOVA and independent t-tests.

Results: The mean OOP payments were 9,826,531 Rials (US$106) in state teaching hospitals, 26,387,097 Rials (US$284) in state non-teaching hospitals, and 74,380,282 Rials (US$800) in private hospitals. OOP costs were significantly associated with hospital type, age, marital status, length of hospitalization, type of insurance and supplementary insurance ($P < 0.05$).

Conclusion: OOP expenses for refractive surgery were substantially lower in governmental hospitals compared to private hospitals. Introducing multi-tiered insurance packages tailored to patient characteristics could improve access and reduce the financial burden of refractive surgery.

Keywords: Refractive surgery; Out-of-pocket payments; Hospitals; Health economics; Iran.

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Introduction

Eye diseases encompass a wide range of disorders that affect ocular function, ranging from mild to severe conditions. According to the World Health Organization (WHO), more than 2.2 billion people worldwide live with visual impairment, including 295 million with moderate to severe impairment and 258 million with mild impairment [1-3].

Refractive errors are among the most common vision problems and occur when the eye does not focus light properly on the retina, resulting in blurred vision. The main types include myopia, hyperopia, astigmatism, and presbyopia [4-6]. Prevalence rates vary widely: 26.3 % in some global studies, 12 % in India, and 1.3 % in Finland [7-9].

In Iran, multiple studies have reported varying prevalence rates across age groups. One university study found accommodation problems in 6.2-10.8 % of students, while another reported a mean refractive error of 0.26 diopters, with myopia and hyperopia affecting 22.6 % and 12.5 % of participants, respectively [10,11].

Refractive errors can lead to blurred vision, eye fatigue, headaches, and difficulty performing daily activities [12-15]. In more severe cases, they reduce quality of life, leading many patients to consider surgical correction [16- 18]. Several factors influence the decision to undergo surgery, including economic status, gender, age, awareness of surgical options, pre-surgery visual acuity, occupation, family size, type of eye disease, surgical method, ease of surgery, and demographic characteristics such as age, gender, and education [19-22]. However, out-of-pocket (OOP) payment is one of the least studied yet most influential factors [23].

OOP costs are shaped by the type of insurance, insurance coverage, and the hospital where the surgery is performed [24]. A 2023 Iranian study estimated the average cost of vision loss and eye disorders at US$250 per patient, with an overall national economic burden of US$2.84 billion annually. Of this, 87 % were direct medical costs, 6 % direct non-medical, and 7 % indirect costs. Insurance companies covered 72.8 % of medical costs, while patients paid 20.6 % and the government 6.6 % [25].

High OOP payments create a barrier to accessing surgical services, potentially worsening patients' conditions, increasing the risk of blindness or low vision, and imposing additional economic and social burdens on society. Policymakers and health managers must recognize this challenge and adopt strategies to prevent the growing prevalence of visual disorders. Since OOP payments differ between public and private centers, it is essential to evaluate them simultaneously. For this reason, the present study was conducted to identify the factors associated with OOP payments for refractive surgery in selected medical centers in Tehran, Iran. The study protocol was approved by the Ethics Committee of Tehran University of Medical Sciences (IR.SUMS.SCHEANUT.REC.1403.110). The study adhered to the principles of the Declaration of Helsinki, and informed consent was obtained from all participants before data collection.

Patients and Method

Study Design and Setting

We conducted an analytical cross-sectional study in six high-volume ophthalmic surgery centers in Tehran in 2025, comprising state teaching, state non-teaching, and private hospitals. Refractive procedures (LASIK, LASEK, PRK) were performed as outpatient care. Reporting follows established guidance

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for cross-sectional studies.

Study Population and Eligibility

Eligible participants were adults (≥ 18 years) undergoing elective keratorefractive surgery (LASIK, LASEK, or PRK) during the study period. Exclusion criteria were inability to provide informed consent or incomplete billing information for the index procedure.

Sample Size and Sampling

The target sample was based on precision for the monetary outcome using the single-population mean formula and the standard deviation reported in prior research[26] (two-sided 95 % confidence level), with a 10 % allowance for non-response, yielding n = 186; we aimed to enroll n = 200 to ensure adequate precision. A multi-stage cluster design was used, with hospitals as clusters. Within each hospital, consecutive eligible patients were invited (convenience within clusters). We tracked screening, eligibility, consent, and completion and replaced non-participants with the next eligible patient from the same cluster to maintain the per-cluster targets.

Outcomes and Variables

The OOP payment for the index refractive surgery, recorded in Iranian Rial (IRR) at the time of service, was defined as the amount paid by the patient (or family) for the medical episode (surgeon/procedure fee, facility/operating room use, consumables/disposables, and routine perioperative medications dispensed by the facility), excluding transportation, lodging, and productivity losses. OOP was abstracted from hospital billing/receipts at discharge; when a receipt was unavailable, the amount was obtained by same-day patient report and cross-checked against the fee schedule when possible.

Independent variables were age (years), sex, education, marital status, basic insurance type, supplementary insurance (yes/no), hospital type (state teaching, state non-teaching, private), and surgery type (LASIK, LASEK, PRK).

Instrument Development and Data Collection

Data were collected via structured face-to-face interviews on the day of surgery using a pretested questionnaire (pilot n=30) reviewed by content experts for face/content validity. The questions covered four sections with close-ended items: (1) demographics (age, sex, education, marital status); (2) coverage (basic insurance type; supplementary insurance yes/no); (3) procedure/provider (surgery type: LASIK/LASEK/PRK; hospital type: state teaching/non-teaching/private); and (4) payments (OOP in IRR taken from the bill/receipt; if unavailable, same-day patient report cross-checked against the fee schedule). Interviewers were trained, used standardized prompts, and recorded reasons for refusal/non-participation. Data were double-entered with automated range and logic checks; discrepancies were resolved against source documents. All monetary figures are expressed in 2025 IRR (price year 2025). For international comparability, we additionally report values in international dollars (PPP-adjusted) using contemporaneous conversion factors; nominal USD conversions (where shown) are labeled with the source and date.

Statistical Analysis

Analyses were pre-specified with OOP as the primary endpoint. Categorical variables are summarized with counts and percentages;

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monetary variables with mean (SD) and median (IQR) due to expected right-skew. Between-group differences in OOP by hospital type and surgery type were assessed using Welch's ANOVA and, as a skew-robust check, the Kruskal–Wallis test. Where multiple pairwise contrasts were examined, we applied Holm's adjustment to control the family-wise error rate. As an interpretable descriptive effect size, we report unadjusted ratios of means with 95 % confidence intervals computed via a log-delta method from group means, SDs, and sample sizes. Missing data were low; analyses used complete cases. Two-sided $\alpha = 0.05$ was considered statistically significant. Analyses were conducted with standard statistical software.

Table 1: Frequency distribution of participants' characteristics

Variable		n	(%)
Age	< 20 years	31	15.5
	20–50 years	111	55.5
	> 50 years	58	29
Sex	Female	101	50.5
	Male	99	49.5
Education	Diploma	78	39
	BSc	62	31
	MSc	44	22
	PhD	16	8
Marital Status	Married	127	63.5
	Single	73	36.5

Ethical Considerations

The study protocol received approval from the institutional ethics committee (approval code: IR.SUMS.SCHEANUT.REC.1403.110). The study adhered to the principles of the Declaration of Helsinki, and all participants provided written informed consent after explanation of the study purpose, voluntary participation, and the right to withdraw without consequences. Data were anonymized prior to analysis and stored on secure, access-controlled servers.

Results

Two hundred adults completed the interviewer-administered questionnaire; completion among those enrolled was 100 %. Baseline characteristics are summarized in Tables 1–2. Overall, 55.5 % were aged 20–50 years and 50.5 % were female; 63.5 % were married and 39.0 % held a diploma. Regarding coverage, 46.0 % reported Social Security insurance and 64.5 % had supplementary insurance. Surgeries were performed in state teaching (49.0 %), state non-teaching (15.5 %), and private hospitals (35.5 %).

Across all participants, the mean OOP was

Table 2: Surgery-related coverage and provider setting

Variable		n	(%)
Type of insurance	Health Insurance	61	30.5
	Social Security	92	46
	Armed Forces	29	14.5
	Other	18	9
Using supplementary insurance	Yes	129	64.5
	No	71	35.5
Type of Hospital	State teaching	98	49
	State non-teaching	31	15.5
	Private	71	35.5

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Table 3: Out-of-pocket (OOP) payments by hospital and surgery type (price year 2025)

Variable	Category	Mean OOP (IRR)	SD (IRR)	PPP international $*
Hospital type	State teaching	9,826,531	31,017,130	83.9
	State non-teaching	26,387,097	36,117,103	225.2
	Private	74,380,282	44,556,663	634.8
	ANOVA (unadjusted)			P = 0.001
Surgery type	LASIK	36,838,235	49,285,828	314.6
	LASEK	24,337,349	31,859,171	207.7
	PRK	51,775,510	60,638,706	442.0
	ANOVA (unadjusted)			P=0.001

* Monetary values are expressed in 2025 IRR (price year 2025). For comparability, PPP international dollars are provided in Table 3 using the World Bank PPP conversion factor (GDP) for Iran; we used 117,170 IRR per international $ (latest available WDI value; applied uniformly to 2025 IRR amounts).

35,310,000 IRR (SD 47,336,854). By hospital type, mean OOP was 9,826,531 IRR in state teaching hospitals, 26,387,097 IRR in state non-teaching hospitals, and 74,380,282 IRR in private hospitals (Table 3). Unadjusted comparisons (ANOVA) indicated significant differences by hospital type and surgery type (both P=0.001). Crude mean ratios (unadjusted) for OOP were 2.69 for state non-teaching vs. state teaching and 7.57 for private vs. state teaching; by surgery type, mean ratios were 1.51 for LASIK vs. LASEK and 2.13 for PRK vs. LASEK.

As a simple effect-size summary (unadjusted), the ratio of mean OOP was 2.69 (95 % CI 1.22–5.91) for state non-teaching vs.. state teaching, and 7.57 (95 % CI 3.99–14.36) for private vs.. state teaching (computed from Table 3 means, SDs, and group sizes with a log-delta method). In additional unadjusted tests, OOP differed by age group, marital status, basic insurance type, and supplementary insurance ($P < 0.05$ for each). (Length of hospitalization was not analyzed because keratorefractive procedures were performed as outpatient care.)

Discussion

This study aimed to assess OOP payments for LASIK, LASEK, or PRK surgery and the associated factors, to provide evidence for developing sustainable cost-recovery models for refractive services. The results showed that mean OOP expenses were 9,826,531 Rials (US$106) in state teaching hospitals, 26,387,097 Rials (US$284) in state non-teaching hospitals, and 74,380,282 Rials (US$800) in private hospitals. These findings differ markedly from reports in Canada (C$24,331), the USA (US$11,302), and England (£405), but are more consistent with reports from Tanzania (US$176.98) and Australia (US$195) [26 - 28]. Thus, refractive surgery in Tehran appears relatively affordable compared with high-income countries, but still costly relative to average income levels.

We found that older patients (over 50 years) had higher OOP payments, consistent with previous studies such as Khammarnia et al.,[29]. This may be explained by their greater need for medications and longer hospital stays. No significant difference in OOP payments was

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observed between men and women, which is expected since costs are determined more by surgery type than by gender. This result aligns with Zarei et al.,[30] but differs from Marzban et al.,[31] and Asefzadeh et al.,[32], likely due to differences in study populations (e.g., imaging or outpatient services rather than refractive surgery).

Married patients in our sample paid more than single patients, while education level showed no effect. Marital status and education may influence hospital choice, but not necessarily the cost of surgery itself. Insurance type was another important factor. Patients with basic health insurance paid less than those covered by Social Security or other schemes. No difference was observed between Armed Forces insurance and health insurance. The lower costs for Health Insurance Organization patients likely reflect referral to state university hospitals with lower tariffs. Interestingly, patients with supplementary insurance paid significantly more than those without [33]. This may reflect older age, better financial status, or a preference for private hospitals with higher fees.

Length of hospitalization was also associated with OOP costs. Patients hospitalized for more than three days had significantly higher expenses, likely due to additional costs for accommodation, medications, and diagnostic services [34]. This contrasts with findings from some earlier studies, possibly due to differences in patient populations and service types Analyzed [35 - 38].

The strength of this study is that it is one of the first in Iran to directly measure OOP costs for refractive surgery using face-to-face interviews and a structured questionnaire, which provides realistic estimates of patient expenses. The relatively large sample size and inclusion of both state and private hospitals increase the representativeness of the findings. However, the study also has limitations. Reliance on self-reported costs may have introduced recall bias, and the contingent valuation method considered only service values rather than the full economic burden. Interviewer-administered questionnaires may have influenced responses, and cultural differences limit generalizability beyond Tehran. Also, the facility-based sample may not represent all providers in Tehran. Future studies across multiple provinces and with a broader economic evaluation approach are recommended.

Conclusion

OOP payments for refractive eye surgery were substantially lower in state hospitals compared with private hospitals. The findings highlight the significant influence of hospital type, insurance coverage, and patient characteristics on surgical costs. Developing multi-tiered insurance packages tailored to these factors could improve access to refractive surgery and reduce the financial burden on patients.

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Footnotes and Financial Disclosures

Conflict of interest:

The authors have no conflict of interest with the subject matter of the present manuscript.

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